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Diagnosis of Interrupted Aortic Arch & Aortopulmonary Window After CCHD Screening

By Jeffrey Nafash, MD, MPH; Adity Joshi, MD; David Sorrentino, MD; Benjamin Lentzner, MD

Introduction

Since 2011, the Secretary of Health and Human Services (HHS) has recommended that screening for Critical Congenital Heart Disease (CCHD) via pulse oximetry be included in the uniform screening panel for all newborn infants in the well-baby nursery.[1]

This screening test has subsequently been endorsed by the American Academy of Pediatrics (AAP). Today, it is estimated that >/= 90% of infants born in the United States undergo this screening prior to discharge from the hospital.[2] Before Universal CCHD screening, up to 37% of CCHD cases were not identified before the first day of life or before discharge from the hospital.[3-5] CCHD screening with pulse oximetry has been shown to have a sensitivity of 76.5% and a specificity of 99.9%.[5,6] Pulse oximetry does not seek to diagnose specific subtypes of heart disease; rather, it is designed to identify patients who would immediately benefit from further evaluation.

An Aortopulmonary Septal Defect, or Aortopulmonary Window (APW), is an abnormal residual interarterial communication between the ascending aorta and the pulmonary artery above the level of the semilunar valves. An Interrupted Aortic Arch (IAA) refers to a complete anatomic discontinuity between two adjacent segments of the aorta along the arch. APWs are rare, appearing in fewer than 0.1%-0.2% of patients with Congenital Heart Defects; in 52% of cases, patients have another accompanying cardiac lesion.[7] Reports of an association of an APW with an IAA (APW+IAA) are limited to isolated case reports and series.[8-11] In 2010, Hayashi et al. reported the first case of APW+IAA that was diagnosed via fetal echocardiography.[9] Here we present a case where pulse oximetry screening alerted medical staff to a possible CCHD that ultimately led to the diagnosis of an APW with a Type A IAA. To our knowledge, this is the first reported case in

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Pediatric Cardiac Step-Down Unit Cardiologist

The Congenital Heart Collaborative (TCHC), an affiliation between University Hospitals Rainbow Babies & Children's Hospital (Cleveland OH) and Nationwide Children's Hospital (Columbus OH) heart programs, seeks candidates at all professorial levels for a faculty position in the Division of Cardiology at Rainbow Babies & Children's Hospital. The candidate would join a multidisciplinary team of academic cardiologists, nurse practitioners, cardiac nurses and allied healthcare professionals providing care within a dedicated cardiac step-down unit and the hospital-wide consultative service. The candidate must be a strong patient care advocate with excellent clinical skills. The physician would work closely with the team members of our Cardiothoracic Intensive Care Unit, Pediatric Cardiothoracic Surgery, and the Division of Pediatric Cardiology to ensure effective care delivery and a safe transition of care in the hospital setting. The candidate will have opportunities to participate in quality improvement, clinical research, and education of medical students, residents, and cardiology fellows. Candidates must be board-eligible or certified in pediatric cardiology. Candidates with past experience or a demonstrated clinical focus on in-patient services are preferred.

The candidates would be well-supported at a world-class children's hospital that has over 60 years of experience in the care of pediatric and adult congenital heart disease patients; an outstanding educational and research enterprise at Case Western Reserve University School of Medicine and an internationally recognized program partner with the Nationwide Children's Hospital Heart Center. TCHC is a dedicated service line with a common executive administration and functions as one program on two campuses with the commitment to expand access to high-quality comprehensive cardiac care regardless of patient age to the communities we serve while equally embracing a scholarly and educational mission. TCHC provide excellent cardiothoracic surgical, cardiac interventional, electrophysiologic, and non-invasive services. The candidate would be immediately accountable to the Cardiology Division Chief and to TCHC medical leadership.

Please send letter and curriculum vitae to:
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Rainbow Babies & Children's Hospital,
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The Congenital Heart Collaborative | University Hospitals Rainbow Babies & Children's Nationwide Children's Hospital

Pediatric Cardiac Intensivist

The Congenital Heart Collaborative (TCHC), an affiliation between University Hospitals Rainbow Babies & Children's Hospital (Cleveland OH) and Nationwide Children's Hospital (Columbus OH) heart programs, seeks candidates at the Assistant or Associate Professor rank for a faculty position in the Division of Pediatric Critical Care at UH Rainbow Babies & Children's Hospital in the role of **Pediatric Cardiac Intensivist**. Candidates should have dual training in Pediatric Critical Care and Cardiology, or Pediatric Critical Care with an additional year of Pediatric Cardiac Critical Care training. The successful candidate will be expected to perform at the highest level, with dedicated clinical service and night call in the Pediatric CTICU. The candidate will also have opportunities to participate in quality improvement initiatives, clinical research, and education of medical students, residents, and fellows.

The successful candidate will be well-supported at a world-class children's hospital with over 60 years of experience in the care of pediatric and adult congenital heart disease patients; an outstanding educational and research enterprise at Case Western Reserve University School of Medicine and an internationally recognized program partner with the Nationwide Children's Hospital Heart Center. TCHC is a dedicated service line with a common executive administration and functions as one program on two campuses with the commitment to expand access to high-quality comprehensive cardiac care regardless of patient age to the communities we serve while equally embracing a scholarly and educational mission. TCHC provides excellent cardiothoracic surgical, cardiac interventional, electrophysiologic, and non-invasive services. The candidate would be immediately accountable to the Pediatric Critical Care Division Chief and to TCHC senior leadership.

Please send letter of interest and curriculum vitae to:
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the published literature where a positive CCHD pulse oximetry screen led to the diagnosis of APW + IAA.

Case

A 30-year-old, gravies 6, para 5, woman delivered at 37 weeks and 5 days a healthy - appearing, 2710g male via an uncomplicated vaginal delivery following an uncomplicated pregnancy. No cardiac malformations were noted during routine prenatal ultrasonography. The baby's initial physical examination in the delivery room was noted to be within normal limits, and he was transferred to the newborn nursery. Initially, he breastfed without difficulty, and was able to breathe comfortably on room air.

On Day of Life (DOL) 1, the infant underwent the Critical Congenital Heart Disease screen and failed. He was noted to have a preductal oxygen saturation of 96% and a post-ductal oxygen saturation of 90%. This was confirmed on repeat testing. On repeat physical exam in the newborn nursery, he was noted to have decreased femoral pulses bilaterally and a grade 1/6 systolic murmur heard best at the left upper sternal border.

The lungs were clear to auscultation bilaterally and there was no hepatomegaly. Blood pressure assessment of all four limbs demonstrated a BP of 71/32 in the right arm, 69/32 in the left arm, 61/22 in the right leg, and 60/28 in the left leg. The infant was subsequently transferred to the Neonatal Intensive Care Unit (NICU) and an echocardiogram was performed. The echocardiogram demonstrated an interrupted aortic arch, Type A (Image 1), a large aortopulmonary window (Image 2 and 3), a moderate-sized Patent Ductus Arteriosus (PDA), a Patent Foramen Ovale, (PFO) and good biventricular systolic function. An alprostadil infusion was started to maintain patency of the ductus arteriosus. The infant was subsequently transported to a quaternary center with a pediatric cardiothoracic surgery program. He underwent successful surgical repair of both the aortic arch and the aortopulmonary window, and the ductus arteriosus was ligated and divided.

Discussion

Congenital Heart Defects (CHD) affect about 1% of births per year. Only 25% of those are considered to be critical and require surgical intervention within the first year of life.[5] Although there has been significant progress in diagnosis and treatment of these conditions, 30% of infant fatalities in the US are secondary to CCHD.[12] While CCHD is rare among live births with CHD, two distinct embryologic congenital heart defects occurring together is exceedingly rare. Our patient had a Type A IAA, which is a ductal-dependent CCHD, as well as an APW. There are three types of IAA based on the location of discontinuity of the aortic arch: Type A occurs between the left subclavian artery and the descending aorta; Type B occurs between the left common carotid and the left subclavian arteries; and Type C occurs between the brachiocephalic and the left common carotid arteries.[13]

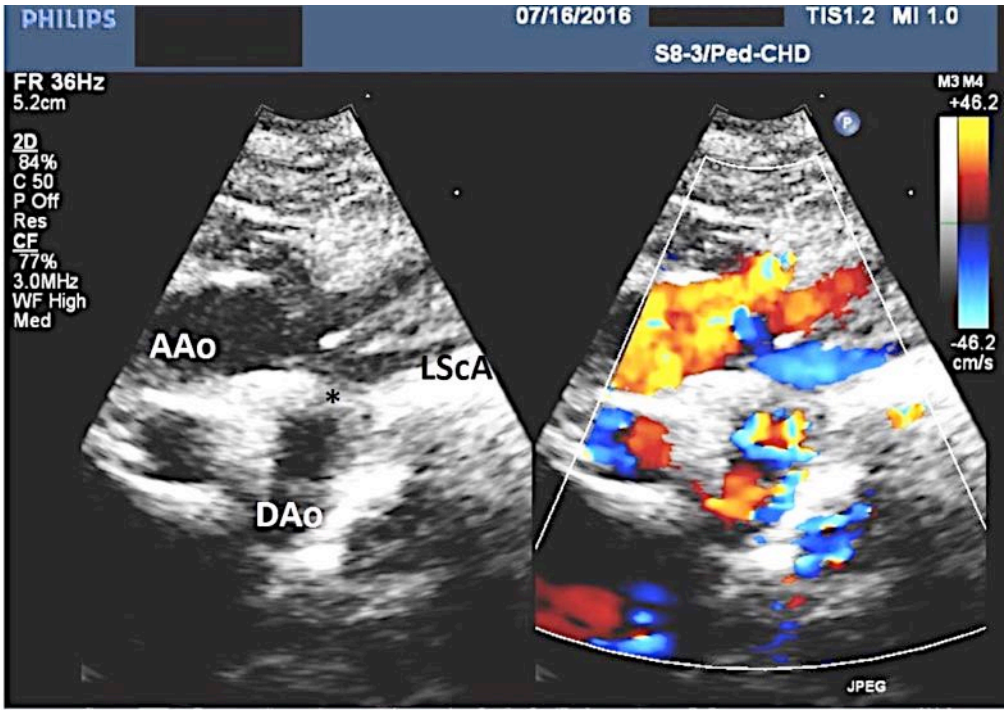

*Figure 1. Echocardiogram image of the interrupted aortic arch, with discontinuity of the aorta distal to the left subclavian artery (LScA). AAo = ascending aorta; Dao = descending aorta; * = region of the interruption.*

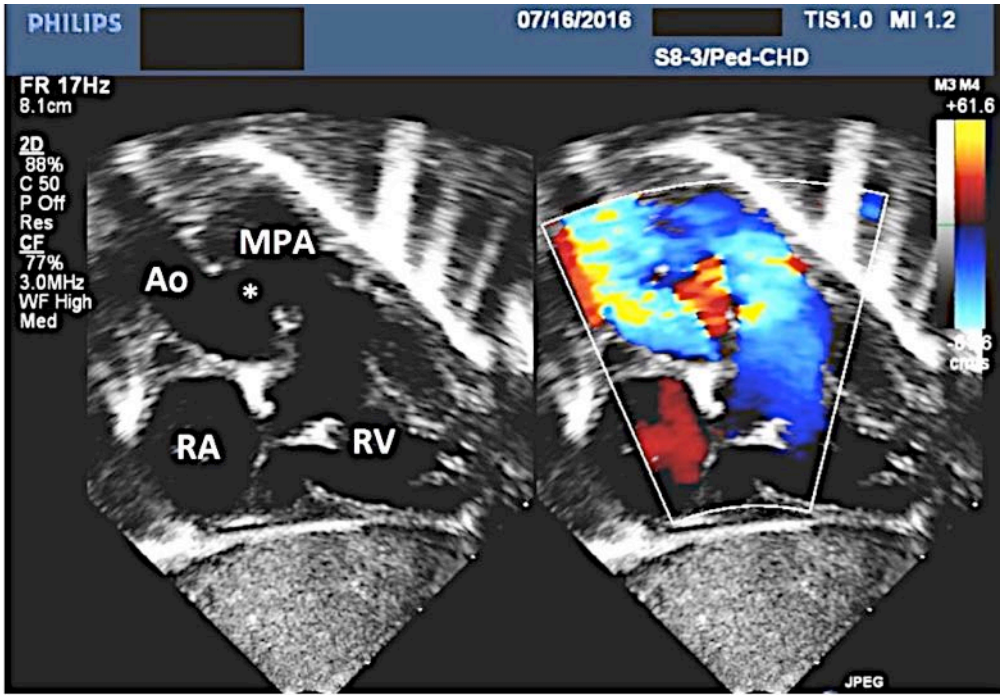

*Figure 2. Echocardiogram image of the Aortopulmonary Window. Ao = aorta; MPA = main pulmonary artery; RA = right atrium; RV = right ventricle; * = Aortopulmonary Window.*

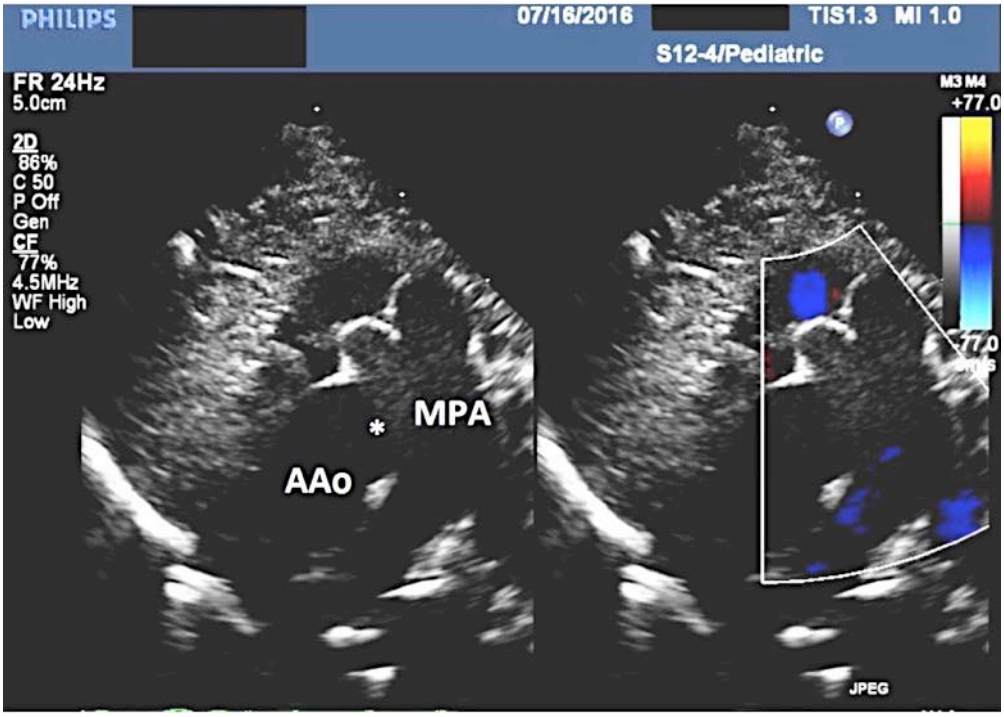

*Figure 3. Echocardiogram image of the Aortopulmonary Window. AAo = ascending aorta; MPA = main pulmonary artery; * = Aortopulmonary Window.*

Interestingly, while Type B is the most common type of IAA when it occurs in isolation, our patient presented with a Type A IAA with an APW, which is consistent with other limited published case reports on IAA occurring with other Congenital Heart Defects.[8,9]

Prenatal diagnosis of aortic arch defects is challenging with ultrasound, and infants with such defects are often asymptomatic at birth. There have been reported cases of APW + IAA detected by fetal echocardiography, but the rarity of these defects makes detection difficult, and routine obstetrical sonography may not always be reliable. Identification of such defects antenatally depends on many factors, including operator expertise, gestational age of the fetus, fetal position, and the type of cardiac defect.[14,15] Vogel et al. in 2010 evaluated the overall fetal diagnosis of IAA, and noted that the ductus arteriosus can often be confused with the aortic arch on ultrasound. Many of the cases are not noted to have abnormalities on routine prenatal ultrasounds, and thus, do not undergo a fetal echocardiogram.[16] Peterson et al. analyzed the cost burden of screening CCHD using pulse oximetry, and reported the screening test to be cost-effective. They found testing incurs a cost of $13.50 per newborn, potentially identifies 1189 newborns with CCHD per year at the birth hospital, and potentially averts 20 infant deaths annually.[17]

Early diagnosis is critical in these cases, whether in the prenatal or early postnatal period, as a delayed diagnosis can result in significant morbidity and mortality. It is also important to consider staff education on the screening tools available for CCHD and appropriate protocols for abnormal screen results. A recent brief in the *NeoReviews* discussed how the lack of staff knowledge and improper reporting systems can result in preventable death.[18] As CCHD screening becomes an integral part of routine newborn care, all members of staff caring for newborn infants need to be informed of this screening, the reason for it being widely adopted, and the important signs and symptoms relating to an abnormal CCHD screen. Garg et al. surveyed pediatric residents at a large academic center and found a significant gap in knowledge across all years of training. Educational interventions with simplified teaching programs can decrease the knowledge gap and empower residents, attending physicians and nurses with the knowledge to be more confident with the screening tool.[19]

Conclusion

Early diagnosis of CCHD is paramount for decreasing morbidity and mortality. Pulse oximetry screening for CCHD has been shown to be a cost-effective and simple test that is able to increase the swift identification of CCHD, and, therefore, subsequently reduce mortality. Our patient is the first known reported case in the medical literature where an abnormal CCHD pulse oximetry screen led to the diagnosis of APW + IAA, which is a very rare combination of CCHD with a potentially fatal outcome.

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Biographical Sketch – Dr. Jeffrey Nafash is a first year Pediatrics Resident at the Rutgers Robert Wood Johnson Medical School. He completed his medical education at the Royal College of Surgeons in Ireland and Masters of Public Health at Thomas Jefferson University.

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Highlights from the 7th Annual Fetal Echocardiography Symposium at UCLA - Los Angeles, California, October 21st, 2017

By Mark S. Sklansky, MD

The 7th Annual Fetal Echocardiography Symposium at UCLA was a tremendous success, continuing UCLA's annual tradition of providing a full day of focused, real-life, clinically oriented instruction for all clinicians involved with fetal cardiac imaging. State-of-the-art presentations were presented by world-class experts in obstetric sonography, maternal-fetal medicine and pediatric/fetal cardiology. As has been the case in previous years, the Seventh Annual symposium sold out, with over 215 registrants (sonographers and physicians—obstetricians, maternal-fetal medicine specialists, and pediatric cardiologists) from across the country. The symposium retained its focus on clinically oriented tips and pearls for both beginning and advanced sonographers and physicians.

In addition, as has become a trademark of this course, the *7th UCLA Fetal Echocardiography Symposium* featured special patient testimonials before the lunch break. Actual patients and their families shared their emotional and captivating stories with the

"The 7th Annual Fetal Echocardiography Symposium at UCLA was a tremendous success, continuing UCLA's annual tradition of providing a full day of focused, real-life, clinically oriented instruction for all clinicians involved with fetal cardiac imaging. State-of-the-art presentations were presented by world-class experts in obstetric sonography, maternal-fetal medicine and pediatric/fetal cardiology."

Top: Dr. Gary Satou; Middle: Dr. Greggory DeVore; Bottom: Dr. Karim Diab

Top: Left-to-right: Drs. Sklansky, Satou, Soffici, DeVore, and Robili.
Middle: Meeting Exhibit area.
Bottom: Dr. Sklansky and patients at the UCLA Mattel Children's Hospital Toy Drive.

egistrants, demonstrating first-hand the tremendous impact of prenatal detection of Congenital Heart Disease (CHD), and the importance of the way a new diagnosis of CHD is first presented to the patient and her family.

Dr. Alex Soffici and Susan Regenhardt.

Registrants left the meeting with new approaches to the prenatal detection and evaluation of CHD to bring back to their practices, meaningful insights into the importance of raising the quality of fetal cardiac imaging, and a commitment from all the speakers to offer continuing education and consultation for registrants throughout the year.

The symposium began with Mishella Perez, BS, RDMS, RDCS, delivering an outstanding presentation on "The Sonographer's Basic Approach to Fetal Cardiac Screening." Dr. Greggory DeVore then reviewed both "Basic and Advanced Pulsed and Spectral Doppler Techniques." Dr. Mark Sklansky discussed his thoughts regarding "What Clinicians and Guidelines are Doing Wrong in Terms of Actual Fetal Cardiac Imaging" — offering answers and solutions to why most cases of major forms of congenital heart disease continue to be missed prenatally.

Session two reviewed traditional and more advanced elements of the three-vessel views, along with traditional and novel (but easy to apply) approaches to the evaluation of fetal arrhythmias. The session ended with Dr. Sklansky demonstrating how to optimize fetal cardiac imaging while performing actual, live scans on multiple

"Before lunch, four young children ages 2-12 years old, and all with various forms of single ventricle, came to the stage along with their parents to give personal testimonials of their own experiences."

Top: Patient Ambassadors. Bottom: Dr. Sklansky and patient (with her twin sister) at the twins' school's Toy Drive for UCLA Mattel Children's Hospital.

models at various gestational ages and with variable fetal positions. *Tricks of the trade* for optimizing image quality and angle of acquisition were demonstrated, and common artifacts were reviewed and minimized.

Before lunch, four young children ages 2-12 years old, and all with various forms of single ventricle, came to the stage along with their parents to give personal testimonials of their own experiences. Many tears were shed throughout the audience, and everyone took home a renewed sense of understanding of the importance of prenatal detection, and of the very real impact that clinicians have on families for many years following the detection of a heart defect.

Following lunch, Dr. Karim Diab reviewed atrial and Ventricular Septal Defects (VSD), including atrioventricular canal. Dr. Gary Satou discussed tricuspid valve disease, including: tricuspid regurgitation, tricuspid dysplasia, and Ebstein's Anomaly (EA) of the tricuspid valve. Dr. DeVore then discussed the latest approaches to evaluating cardiac size, shape and function, incorporating state-of-the-art speckle tracking technology.

Session four focused strictly on outflow tract pathology, including aortic/pulmonary valve stenosis, pulmonary atresia with intact ventricular septum,Tetralogy of Fallot (TOF), Double Outlet Right Ventricle (DORV), Transposition of the Great Arteries (TGA), and Truncus Arteriosus (TA). The special views required for detection of Transposition of the Great Arteries, for example, were reviewed in detail.

The symposium kept registration fees well below the national average through the generous support of the Hopeful Hearts Foundation (www.hopeful-hearts.org), GE Healthcare (www.gehealthcare.com), Samsung (www.samsunghealthcare.com), Masimo (www.masimo.com), Natera (www.natera.com), and the Shane McCusker Foundation (www.shanesheart.org).

"...everyone took home a renewed sense of understanding of the importance of prenatal detection, and of the very real impact that clinicians have on families for many years following the detection of a heart defect."

Reviews of this year's symposium have been glowing. Based on feedback from attendees, plans are already underway for the *8th Annual Fetal Echocardiography Symposium* at UCLA next October; exact date and further details to be announced soon.

For more information on the 2018 meeting, please contact Dr. Sklansky at msklansky@mednet.ucla.edu.

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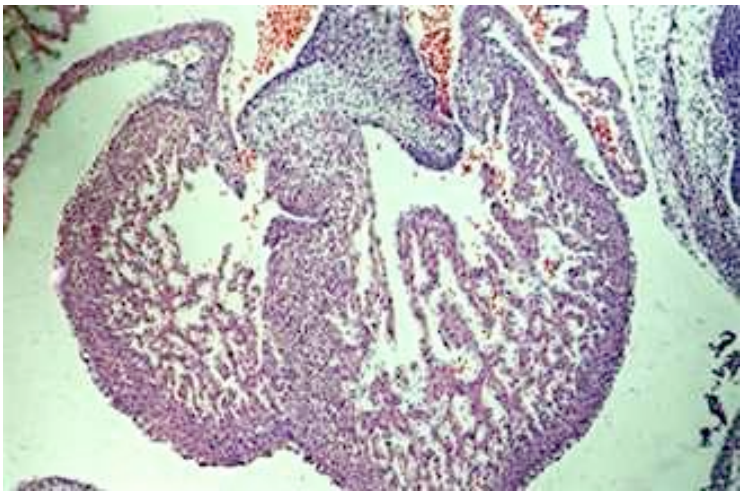
Medical News, Products & Information

Compiled and Reviewed by Tony Carlson, Senior Editor

Blood Flow in the Developing Heart Guides Maturation of Heart Valves - *Penn animal study has implications for most common type of birth defect*

Congenital heart valve defects appear in 2% of all live births, making them the most common type of birth defect. While some of these defects have been linked to specific genetic mutations, the majority have no clearly definable genetic cause, suggesting that epigenetic factors – changes in gene expression versus an alteration in the genetic code -- play an important role. Now researchers from the Perelman School of Medicine at the University of Pennsylvania have found that the force, or shear, of blood flow against the cells lining the early heart valve sends signals for heart "cushion" cells to become fully formed valves. Their findings are published in *Developmental Cell.*



Remodeling valves in a 13.5-day-old embryonic mouse heart. Credit: Lauren Goddard, PhD, Perelman School of Medicine, University of Pennsylvania.

Heart valves ensure that the beating heart drives blood flow in one direction. As the heart beats continuously over a lifetime, valve function must be flawless. Obstruction of forward flow or backward flow due to a defective valve can result in heart failure. Most serious valve defects are treated surgically, with the original valve able to be repaired and or replaced. However, in general, valve replacements are held off in growing children for as long as possible to avoid outgrowing a valve replaced too early.

Embryonic heart valves develop as large cushions that, during development, reshape and thin to form mature valve leaflets. "The maturation of these big fluffy cushions into the perfectly fitting leaflets of a mature heart valve is an architectural marvel," said senior author Mark Kahn, MD, a Professor of Cardiovascular Medicine. "We showed that shear-responsive KLF2-Wnt protein signaling is the basis of this remodeling."

Lauren Goddard, PhD, a postdoctoral researcher in the Kahn Lab, found that the protein KLF2 was expressed by the shear-sensing cells that line the primitive valve cushions. KLF2's expression was highest in the regions of the valve that experience the strongest shear forces. Using mouse models, she found that deletion of KLF2 in these cells resulted in large cushions that failed to mature properly. Profiling of the genes expressed by early cardiac cushion cells revealed that loss of KLF2 resulted in a significant decrease in the expression of the Want binding partner, WNT9B, a molecule important in the valve maturation communication path.

Loss of WNT9B in the mouse resulted in defective valve remodeling similar to what happens when KLF2 is deleted, suggesting it is a key downstream target of KLF2. Work done by co-author Julien Vermont from the Agency National de la Recherché, an expert in how shear forces determine zebrafish development, demonstrated that expression of the gene for WNT9B is restricted to the cells that govern developing heart valves and is dependent on the sheer force of early blood flow. These findings were instrumental in linking shear forces to KLF2-WNT9B signaling during valve remodeling.

This work is the first to demonstrate how blood flow shapes developing heart valves into mature valve leaflets. These studies, say the researchers, predict that even a minor breakdown in the series of precisely orchestrated cell-cell communications required to accurately pass on signals from blood flow may result in subtly defective valves. This idea supports an epigenetic explanation for common congenital valve defects.

The research was supported by the National Institutes of Health (R01HL094326, T32HL007954, R0111770, R01116997), the Agency National de la Recherché, and the European Research Council.

Penn Medicine is one of the world's leading academic medical centers, dedicated to the related missions of medical education, biomedical research, and excellence in patient care. Penn Medicine consists of the Raymond and Ruth Perelman School of Medicine at the University of Pennsylvania (founded in 1765 as the nation's first medical school) and the University of Pennsylvania Health System, which together form a $6.7 billion enterprise.

The Perelman School of Medicine has been ranked among the top five medical schools in the United States for the past 20 years, according to *U.S. News & World Report's* survey of research-oriented medical schools. The School is consistently among the nation's top recipients of funding from the National Institutes of Health, with $392 million awarded in the 2016 fiscal year.

The University of Pennsylvania Health System's patient care facilities include: The Hospital of the University of Pennsylvania and Penn Presbyterian Medical Center -- which are recognized as one of the nation's top "Honor Roll" hospitals by *U.S. News & World Report* -- Chester County Hospital; Lancaster General Health; Penn Wissahickon Hospice; and Pennsylvania Hospital -- the nation's first

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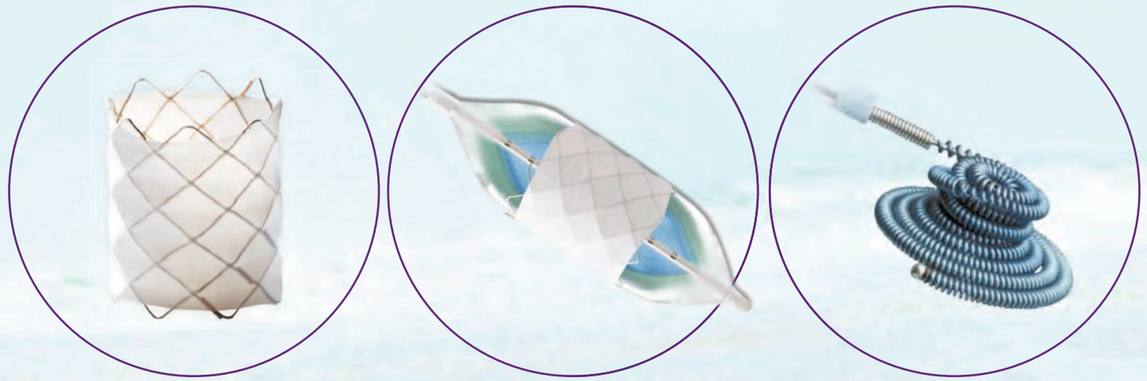

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Study Shows Minimally Invasive Valve Replacements Hold Up Well After Five Years

A minimally invasive procedure used to replace heart valves without open heart surgery appears to provide a durable remedy for people with a life-threatening form of heart disease in which the aortic valve opening narrows, diminishing blood flow.

The procedure, called Transcatheter Aortic Valve Replacement, or TAVR, has been safely used in older patients who are not good candidates for open heart surgery. But strong research establishing its durability over five to 10 years has been lacking. This has created questions about whether it should be used in younger and healthier people.

Now a study, published in *JAMA Cardiology* and led by a member of the Duke Clinical Research Institute, provides some answers. Using data and follow-up from the first and largest studies of TAVR safety, the research team found that the biologic valves used in a TAVR procedure, as well as those used in open heart surgery, continue to perform well up to five years after implantation.

"I think these findings are incredibly reassuring at least out to five years," said lead author Pamela Douglas, MD, the Ursula Geller Professor for Research in Cardiovascular Diseases at Duke University School of Medicine and Director of the DCRI, "The valve is quite durable and safe."

Douglas and colleagues analyzed data from more than 2,700 patients who had been part of a large trial called PARTNER, which established the safety of TAVR. The study patients received either a minimally invasive TAVR procedure - which uses a catheter that is routed through a blood vessel in the leg or chest to access the

heart -- or an open-heart surgery to replace the valve.

All of the study patients received biological valves, developed from animal or donated human tissue. Biological valves are increasingly favored over mechanical valves, which must be surgically implanted and require long-term use of anti-coagulation drugs to protect against blood clots.

In their analysis, the study authors also included 4 of about 475 patients five years after either their minimally invasive or surgical valve replacement. The average age of patients in the study group was 84.5 years, and many had additional serious health risks.

Among the 2,404 TAVR patients in the study, 34% survived five years. Similarly, 37% of the 313 patients whose valves were replaced in an open surgery also survived to five years.

Twenty TAVR patients (0.8%) required a second valve procedure, and only five of the revisions arose from structural deteriorations of the valve.

The researchers found evidence that 3.7% of the TAVR patients developed a condition in which the valve allowed blood to flow back into the heart, and this problem increased over time.

"This was seen in only a handful of patients, but it's certainly something of concern and warrants further study," Douglas said. "Overall, however, the findings from this carefully designed study demonstrate that there is little evidence of valve failure or deterioration for either TAVR or surgery using biological valves."

She said the study provides a first step in understanding the long-term benefits of minimally invasive valve replacement, and suggests additional studies could be safely undertaken.

In addition to Douglas, study authors include: Martin B. Leon, Michael J. Mack, Lars G. Svensson, John G. Webb, Rebecca T. Hahn, Pillippe Pibarot, Neil J. Weissman, D. Craig Miller, Samir Kapadia, Howard C. Hermann, Susheel K. Kodell, Raj R. Makkar, Vinod H. Thourani, Stamatios Lerakis, Ashley M. Lowry, Jeevanantham Rajeswaran, Matthew T. Finn, Maria C. Alu, Craig R. Smith and Eugene H. Blackstone for the PARTNER Trial investigators.

The study was funded by Edwards Lifesciences, which markets TAVR products. Author conflicts of interest are listed in the manuscript.

Newborns with Trisomy 13 or 18 Benefit from Heart Surgery, Study Finds

Heart surgery significantly decreases in-hospital mortality among infants with either of two genetic disorders that cause severe physical and intellectual disabilities, according to a new study by a researcher at the Stanford University School of Medicine and his colleagues at the University of Arkansas for Medical Sciences.

Trisomy 13 and 18, which result from having extra chromosomes, often cause heart defects. Infants with the conditions generally die within their first year. Many die within weeks, if not days, of being born.

Due to these infants' short life expectancy, their heart conditions are often treated with standard medical care -- blood pressure medication, ventilators and intravenous fluids -- but not surgery. Many hospitals rarely give parents the option of surgery for their child. "The thought has been it doesn't make sense to undertake a major heart surgery if the patient's death within a few months is a near certainty," said Thomas Collins, MD, Clinical Associate Professor of Pediatric Cardiology at the Stanford University School of Medicine.

But Collins and his co-authors at the University of Arkansas for Medical Sciences analyzed the outcomes of the 100 babies with Trisomy 13 or 18 in the study who had received heart surgery, and recorded the health impacts. What they found was that patients who underwent heart surgery had a significant decrease in mortality, and that the impact lasted for the next two years. "We thought we'd show no difference in survival, but it turns out there's a marked one," Collins said.

A study describing the team's findings was published online Oct. 17 in *Pediatrics*. Collins, the senior author, was on the faculty of the University of Arkansas for Medical Sciences when much of the work

was done. The lead author is Katherine Kosiv, MD, a Cardiology Fellow at the university.

Largest study of its kind

Using data gathered from 44 children's hospitals across the United States between 2004 and 2015, the researchers reported outcomes for nearly 1,600 patients, the largest study ever of infants with Trisomy 13, also known as Patau Syndrome, or Trisomy 18, also known as Edwards Syndrome, Collins said.

The researchers found that heart surgery increased survival and hospital discharge on average from 33% to approximately 67% for these patients, and that this benefit lasted through two years of follow-up. "When we analyzed the survival curves, the data spoke for themselves," Collins said. "Especially for Trisomy 18, the number of babies that survive more than doubles after surgery."

Most infants in the study were admitted at less than a day old, and 51% of infants in the study who had Congenital Heart Defects died in the hospital or were discharged to hospice. The researchers also found that in-hospital mortality decreased in infants who were older at their admission date, heavier and female, corroborating previous findings.

Challenging the narrative

Collins said his goal is to challenge the narrative surrounding these two conditions, much like how the story of Trisomy 21, or Down Syndrome, has changed in the last 40 years.

"Back in 1975, folks would've said there's nothing we can do to help those babies," he said. "But now people have proven if you do heart surgery early, patients with Down Syndrome can live to adulthood and be active members of their community. The difference it makes for them is tremendous." Forty percent of people with Down Syndrome have Congenital Heart Disease, Collins said. And unlike cases of Trisomy 13 and 18, it is now standard-of-care to operate on children with Down Syndrome.

Scientists aren't sure why Trisomy 13 and 18 are associated with higher rates of congenital heart disease than Trisomy 21, and why patient death rates are so much higher.

Collins is certain, however, that Trisomy 13 and 18 patients have far more neurological and developmental issues than those with Down Syndrome, and is unsurprised at hospitals' attitudes that surgery is considered a big risk to take with patients who have a low likelihood of survival anyway.

Still, he suspects that the results of this study might shift the paradigm of how babies with Trisomy 13 and 18 are cared for. "Surgery gives parents the option to say, 'We're going to do everything we can for our baby,'" said Collins. "And, now we've shown that heart surgeries could allow parents to take their babies home from the hospital, and have them for two years or beyond, as opposed to two weeks."

Collins also said that taking care of the patients' heart problems early on could enable caregivers to then properly analyze other

health issues and perform follow-up procedures, such as tracheotomies, to improve the infants' respiration. His next study, in fact, is looking at all the risk factors other than heart disease in more than 3,000 Trisomy 13 and 18 patients and analyzing how their collective health problems fit together. Collins hopes eventually to create a guideline for pediatric caregivers to determine which problems to treat in which order.

His work teasing out the most effective treatments for these babies ties into Stanford Medicine's focus on precision health, the goal of which is to anticipate and prevent disease in the healthy and precisely diagnose and treat disease in the ill.

Two researchers at the University of Arkansas for Medical Sciences are also co-authors.

The research did not receive external funding. The data were acquired from the Pediatric Health Information System as part of the use agreement with participating hospitals.

Babies Born Late Preterm May Be at Risk of Cardiovascular Diseases

Babies born late preterm at 35 weeks are at a higher risk of cardiovascular disease in adult life than those born at full-term, according to research published in *Experimental Physiology.*

Researchers from Hudson Institute of Medical Research and Monash University, Australia found that lambs born preterm were more likely to show altered control of the heart by the part of their nervous system under subconscious control (sympathetic and parasympathetic nervous system).

Young adult females of late preterm birth were more likely to have decreased sympathetic nervous system activation of the heart. This is an early marker of cardiovascular disease, and it occurred in otherwise healthy lambs. In males, the results were different; adult premature males didn't have the innate reflexes that normally bring their blood pressure back to normal when it gets too low or too high.

Researchers looked at a pre-clinical model of late preterm birth using sheep. The sheep were given drugs to induce early labour (or allowed to give birth naturally). Sheep were followed for up to a year and then underwent extensive testing for cardiovascular and metabolic function.

Further research into the organs of these animals is being carried out to see if changes to these could have contributed to the results observed.

Corresponding author Dr Beth Allison said: 'Importantly, these lambs were not born very premature; they were the equivalent of 35 week human babies. Infants born at this time are generally considered very low risk for morbidity and mortality after birth.'

Mindfulness May Help Mothers Cope with Stress When Their Babies Have a Heart Condition

Mindfulness may offer an active coping mechanism for mothers faced with the stress of having a newborn diagnosed with Congenital Heart Disease (CHD). Mindfulness, which aims to increase a person's awareness and acceptance of daily experiences, is currently used in a variety of healthcare settings as a potentially effective skill for stress reduction, emotion, affect and attention regulation.

A team of nurse-researchers from Children's Hospital of Philadelphia (CHOP) and the University of Pennsylvania School of Nursing (Penn Nursing) published a study in the *Journal of Pediatric Nursing* in which they gathered perspectives on coping mechanisms from focus groups with 14 mothers of critically ill infants, and explored the feasibility of mindfulness as a stress-reduction technique.

"Mothers of infants with Complex Congenital Heart Disease are exposed to increased stress, which has been associated with numerous adverse outcomes," said Barbara Medoff-Cooper, PhD, RN FAAN, principal investigator and nurse scientist in the Cardiac Center at Children's Hospital of Philadelphia and at Penn Nursing. "The coping mechanisms these mothers use critically impacts the family's adaptation to the illness, and most likely infant outcomes as well."

"Thus far, parental interventions in the CICU generally are informative or educational, aiming to increase parental abilities to actively manage the caretaking demands of an infant with CHD," said Nadya Golfenshtein, PhD, RN, lead author of the study and a researcher at Penn Nursing. "Mindfulness can be a helpful tool that assists mothers during an incredibly stressful time for them, and for their family by allowing them to pause and be present in the moment rather than wishing something different was happening or worrying about tomorrow."

The researchers collected data during focus groups between July 2015 and March 2016. The sessions included a short introduction to mindfulness as a stress reduction intervention, led by a moderator who is a psychotherapist experienced in group formats.

"In the study, mothers described the post-diagnostic period, surgery and the Cardiac Intensive Care Unit stay as extremely stressful," said Amy J. Lisanti, PhD, RN, CCNS, CCRN-K, nurse researcher at CHOP and NRSA postdoctoral fellow at the University of Pennsylvania. "Many expressed concerns regarding the post-discharge period when they would need to independently handle their infant's condition. Their increased stress often led them to feel out-of-control, lethargic and not like themselves. They acknowledged the importance of stress reduction, recognizing that relief from stress could help them sleep better, recharge energy, focus and think clearly."

After experiencing a brief guided session of mindfulness in a focus group, one mother said, "Most meditation is about clear your mind and lose focus, but this is to focus on now. I think it works for me, I was never able to do the clear mind thing. This is more accessible to me." Another noted, "This is something I'm doing for myself, remembering I'm part of this too. Sometimes you are on autopilot, making sure everyone else is ok. Yes, this is a moment when I'm doing something for myself."

The mothers agreed that mindfulness should start early, preferably immediately after the prenatal CHD diagnosis. That way, they felt, that they would have time to learn and practice the skill by the time the baby is born. There was also a general agreement that the worst time to begin the practice is around surgery, as that is an overwhelming time and mothers are too busy to learn a new skill. The mothers preferred engaging in mindfulness in a private, quiet room as the sounds of the CICU stress them and may prevent them from relaxing.

"We hope to design a program that draws from these findings and more research on mindfulness meditation is needed in a larger cohort of mothers," added Golfenshtein.

The CHOP Cardiac Center Research Fund supported this project. Nadya Golfenshtein, et al. "Coping with the stress in the cardiac intensive care unit: Can mindfulness be the answer?" *Journal of Pediatric Nursing,* Aug. 12, 2017. http://dx.doi.org/10.1016/jpedn.2017.08.021

Children's Hospital has fostered many discoveries that have benefited children worldwide. Its pediatric research program is among the largest in the country. For more information, visit www.chop.edu.

The University of Pennsylvania School of Nursing is one of the world's leading schools of nursing. For the second year in a row, it is ranked the #1 nursing school in the world by QS University, and has four graduate programs ranked number one by *U.S. News & World Report,* the most of any school in the U.S.

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Dr. Joseph Lamelas Offers Minimally Invasive Option for Replacing Ascending Aorta

While not as common as some heart conditions, an ascending aortic aneurysm can be a life-threatening condition. Dr. Joseph Lamelas, Professor and Associate Chief of Cardiac Surgery in the Michael E. DeBakey Department of Surgery at Baylor College of Medicine, explains the condition as well as the minimally invasive procedure that he offers to treat it.

The aorta, the largest blood vessel in the body, carries oxygen-rich blood from the heart to the organs and the rest of the body. An aneurysm, or bulge, occurs when the wall of the artery weakens and can be life-threatening if it ruptures in the ascending aorta.

Ascending aortic aneurysms are common in both young and older adults, those with atherosclerosis and those who have connective tissue disorders.

To prevent rupture or tear, also known as an aortic dissection, the ascending aorta must be replaced to keep the bulge from continuing to grow. Lamelas is able to do this using a minimally invasive approach through a five to six centimeter incision on the right side of the chest, rather than the traditional approach that involves cutting the chest open

“A minimally invasive approach results in less blood loss, fewer transfusions and a quicker recover period,” said Lamelas, who conducts surgeries at Baylor St. Luke’s Medical Center. “Patients are usually out of the hospital in three or four days, and those who are traveling for the procedure are able to fly back home two days after discharge.”

Patients who have a bicuspid aortic valve, meaning their aortic valve, which regulates blood flow to and from the heart, only has two leaflets rather than three, have more of a predisposition to develop an ascending aortic aneurysm. For these patients, if their ascending aorta grows more than 4.5 centimeters, it is an indication that they should get the ascending aorta replaced before it tears. Those patients with a tricuspid valve, the normal configuration of three leaflets, should replace their ascending aorta if it is dilated five to 5.5 centimeters or more.

For many patients who require ascending aorta replacement, there also is a need to replace the aortic valve because the valve is narrowing. Lamelas is able to perform both of these replacements in one minimally invasive procedure.

MEDICAL MEETINGS

NeoPREP - An Intensive Review & Update of Neonatal/Perinatal Medicine, Sponsored by the American Academy of Pediatrics & the AAP Section on Neonatal-Perinatal Medicine
Jan. 20-26, 2018; Atlanta, GA USA
shop.aap.org/live-activities

CSI Asia Pacific
Jan. 31 - Feb. 3, 2018; Ho Chi Minh City, Vietnam
www.csi-congress.org/csi-asia-pacific.php

15th International Conference on Pediatric and Pediatric Cardiology
Feb. 19-20, 2018; Paris France
pediatriccardiology.conferenceseries.com/europe/

Cardiology 2018
Feb 21-25, 2018; Scottsdale, AZ USA
www.chop.edu/events/cardiology-2018

ACC 67th Annual Scientific Session & Expo
Mar. 10-12, 2018; Orlando, FL USA
https://accscientificsession.acc.org/Information-Pages/future-meetings

CSI, Imaging & Innovation
Jun. 27- Jul. 3, 2018; Frankfurt, Germany
www.csi-congress.org/index.php

Pediatric & Congential Heart Sugery and 18th Annual International Symposium on Congential Heart Disease
Jul. 22-26, 2018; Orlando, FL USA
www.cvent.com/events/6th-scientific-meeting-of-the-world-society-for-pediatric-and-congenital-heart-surgery/event-summary-7f53a0c01ccd45cf86a739b3ac5d15db.aspx

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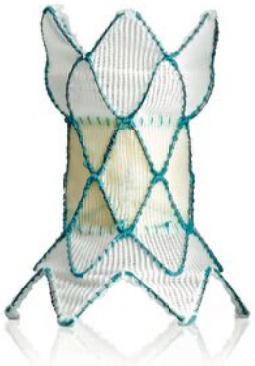

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HOW CAN I LEARN MORE ABOUT THE HARMONY TPV CLINICAL STUDY?

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